Next Generation Grade 10 List of Standards Assessed on MCAS

The next-generation MCAS test for grade 10 mathematics will assess the standards that overlap between the Model Algebra I and Model Geometry courses and the Model Mathematics I and Model Mathematics II courses. The table below includes standards that will be assessed on the grade 10 mathematics test.

Cluster	Standard
N-RN.A Extend the properties of exponents to rational exponents.	N-RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.* N-RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.
N-RN.B Use properties of rational and irrational numbers.	N-RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
N-Q.A Reason quantitatively and use units to solve problems.	N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. N-Q.2 Define appropriate quantities for the purpose of descriptive modeling. N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. a. Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure.
A-SSE.A Interpret the structure of linear, quadratic, and exponential expressions with integer exponents.	A-SSE.1 Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1 + r)^t$ *as the product of P and a factor not depending on P.* A-SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see* $(x + 2)^2 - 9$ *as a difference of squares that can be factored as* $((x + 2) + 3)((x + 2) - 3)$.
A-SSE.B Write expressions in equivalent forms to solve problems.	A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

A-APR.A Perform arithmetic operations on polynomials.	A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under certain operations. a. Perform operations on polynomial expressions (addition, subtraction, multiplication), and compare the system of polynomials to the system of integers when performing operations. b. Factor and/or expand polynomial expressions, identify and combine like terms, and apply the Distributive Property.
A-CED.A Create equations that describe numbers or relationships.	A-CED.1 Create equations and inequalities in one variable and use them to solve problems. (Include equations arising from linear, quadratic, and exponential functions with integer exponents.) A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED.3 Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* A-CED.4 Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations (Properties of equality). *For example, rearrange Ohm's law* $R = \frac{V^2}{P}$ *to solve for voltage, V. Manipulate variables in formulas used in financial contexts such as for simple interest* $(I = Prt)$.
A-REI.A Understand solving equations as a process of reasoning and explain the reasoning.	A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify or refute a solution method.
A-REI.B Solve equations and inequalities in one variable.	A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. a. Solve linear equations and inequalities in one variable involving absolute value. A-REI.4 Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g. for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the solutions of a quadratic equation results in non-real solutions and write them as $a \pm bi$ for real numbers a and b.
A-REI.C Solve systems of equations.	A-REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A-REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ *and the circle* $x^2 + y^2 = 3$.

A-REI.D Represent and solve equations and inequalities graphically.	A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Show that any point on the graph of an equation in two variables is a solution to the equation. A-REI.11 Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions and make tables of values. Include cases where $f(x)$ and/or $g(x)$ are linear and exponential functions. A-REI.12 Graph the solutions of a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set of a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
F-IF.A Understand the concept of a function and use function notation.	F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then $f(x)$ denotes the output (range) of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation $y = f(x)$. F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. *For example, given a function representing a car loan, determine the balance of the loan at different points in time.* F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n - 1)$ *for* $n \geq 1$.
F-IF.B Interpret linear, quadratic, and exponential functions with integer exponents that arise in applications in terms of the context.	F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
F-IF.C Analyze functions using different representations.	F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph piecewise-defined functions, including step functions and absolute value functions. e. Graph exponential functions showing intercepts and end behavior. F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, maximum/minimum

	values, and symmetry of the graph, and interpret these in terms of a context. *b.* Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, *and* $y = (1.2)^{t/10}$ *and classify them as representing exponential growth or decay; Apply to financial situations identifying appreciation and depreciation rate for the value of a house or car some time after its initial purchase:* $V = P(1 + r)^n$. F-IF.9 Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way. *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
F-BF.A Build a function that describes a relationship between two quantities.	F-BF.1 Write linear, quadratic, and exponential functions that describe a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
F-BF.B Build new functions from existing functions.	F-BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Include linear, quadratic, exponential, and absolute value functions. Utilize technology to experiment with cases and illustrate an explanation of the effects on the graph. F-BF.4 Find inverse functions algebraically and graphically. a. Solve an equation of the form $f(x) = c$ for a linear function f that has an inverse and write an expression for the inverse.
F-LE.A Construct and compare linear, quadratic, and exponential models and solve problems.	F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly quadratically, or (more generally) as a polynomial function.
F-LE.B Interpret expressions for functions in terms of the situation they model.	F-LE.5 Interpret the parameters in a linear or exponential function (of the form $f(x) = b^x + k$) in terms of a context.
G-CO.A Experiment with transformations in the plane.	G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

	G-CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. G-CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. G-CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
G-CO.B Understand congruence in terms of rigid motions.	G-CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. G-CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. G-CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
G-CO.C Prove geometric theorems and, when appropriate, the converse of theorems.	G-CO.9 Prove theorems about lines and angles. Theorems include: angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent, and conversely prove lines are parallel; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. G-CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent, and conversely prove a triangle is isosceles; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. G-CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. a. Prove theorems about polygons. Theorems include the measures of interior and exterior angles. Apply properties of polygons to the solutions of mathematical and contextual problems.
G-CO.D Make geometric constructions.	G-CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. G-CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
G-SRT.A Understand similarity in terms of similarity transformations.	G-SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

	b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. G-SRT.3 Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.
G-SRT.B Prove theorems involving similarity.	G-SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. G-SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G-SRT.C Define trigonometric ratios and solve problems involving right triangles.	G-SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. G-SRT.7 Explain and use the relationship between the sine and cosine of complementary angles. G-SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G-C.A Understand and apply theorems about circles.	G-C.1 Prove that all circles are similar. G-C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. G-C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral and other polygons inscribed in a circle.
G-C.B Find arc lengths and areas of sectors of circles.	G-C.5 Derive, using similarity, the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
G-GPE.A Translate between the geometric description and the equation for a conic section.	G-GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. G-GPE.2 Derive the equation of a parabola given a focus and directrix.
G-GPE.B Use coordinates to prove simple geometric theorems algebraically.	G-GPE.4 Use coordinates to prove simple geometric theorems algebraically, including the distance formula and its relationship to the Pythagorean Theorem. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,* $\sqrt{3}$*) lies on the circle centered at the origin and containing the point (0, 2).* G-GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). G-GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

	G-GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
G-GMD.A Explain volume formulas and use them to solve problems.	G-GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments. G-GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
S-ID.A Summarize, represent, and interpret data on a single count or measurement variable. Use calculators, spreadsheets, and other technology as appropriate.	S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
S-ID.B Summarize, represent, and interpret data on two categorical and quantitative variables.	S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a linear function to the data and use the fitted function to solve problems in the context of the data. Use functions fitted to data or choose a function suggested by the context (emphasize linear and exponential models). b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.
S-ID.C Interpret linear models.	S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID.9 Distinguish between correlation and causation.
S-CP.A Understand independence and conditional probability and use them to interpret data from simulations or experiments.	S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S-CP.3 Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. S-CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

	S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*
S-CP.B Use the rules of probability to compute probabilities of compound events in a uniform probability model.	S-CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. S-CP.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.